Carseats-knn.R

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```
library(ISLR)
```

```
## Warning: package 'ISLR' was built under R version 4.0.3
```

```
data(Carseats)
summary(Carseats)
```

```
##      Sales          CompPrice       Income        Advertising
##  Min.   : 0.000   Min.   : 77   Min.   : 21.00   Min.   : 0.000
##  1st Qu.: 5.390   1st Qu.:115   1st Qu.: 42.75   1st Qu.: 0.000
##  Median : 7.490   Median :125   Median : 69.00   Median : 5.000
##  Mean   : 7.496   Mean   :125   Mean   : 68.66   Mean   : 6.635
##  3rd Qu.: 9.320   3rd Qu.:135   3rd Qu.: 91.00   3rd Qu.:12.000
##  Max.   :16.270   Max.   :175   Max.   :120.00   Max.   :29.000
##    Population        Price        ShelveLoc        Age          Education
##  Min.   : 10.0   Min.   : 24.0   Bad   : 96   Min.   :25.00   Min.   :10.0
##  1st Qu.:139.0   1st Qu.:100.0   Good  : 85   1st Qu.:39.75   1st Qu.:12.0
##  Median :272.0   Median :117.0   Medium:219   Median :54.50   Median :14.0
##  Mean   :264.8   Mean   :115.8                Mean   :53.32   Mean   :13.9
##  3rd Qu.:398.5   3rd Qu.:131.0                3rd Qu.:66.00   3rd Qu.:16.0
##  Max.   :509.0   Max.   :191.0                Max.   :80.00   Max.   :18.0
##  Urban       US
##  No :118   No :142
##  Yes:282   Yes:258
##
##
##
##
```

```
names(Carseats)
```

```
##  [1] "Sales"       "CompPrice"   "Income"      "Advertising" "Population"
##  [6] "Price"       "ShelveLoc"   "Age"         "Education"   "Urban"
## [11] "US"
```

```
library(e1071)
```

```
## Warning: package 'e1071' was built under R version 4.0.3
```

```
library(caTools)
```

```
## Warning: package 'caTools' was built under R version 4.0.3
```

```
library(class)
```

```
## Warning: package 'class' was built under R version 4.0.3
```

```
fix
```

```
## function (x, ...)
## {
##     subx <- substitute(x)
##     if (is.name(subx))
##         subx <- deparse(subx)
##     if (!is.character(subx) || length(subx) != 1L)
##         stop("'fix' requires a name")
##     parent <- parent.frame()
##     if (exists(subx, envir = parent, inherits = TRUE))
##         x <- edit(get(subx, envir = parent), title = subx, ...)
##     else {
##         x <- edit(function() {
##         }, title = subx, ...)
##         environment(x) <- .GlobalEnv
##     }
##     assign(subx, x, envir = .GlobalEnv)
## }
## <bytecode: 0x00000000139fdff0>
## <environment: namespace:utils>
```

```
set.seed(9850)
gp<-runif(nrow(Carseats))
gp
```

```
##   [1] 0.7495758825 0.9970860172 0.6520019539 0.4329282779 0.3323124126
##   [6] 0.8654064713 0.1793312423 0.4784936542 0.2957953140 0.6644065792
##  [11] 0.7117703257 0.7801193437 0.1356792178 0.0819188494 0.6316598309
##  [16] 0.5296842461 0.0170833713 0.9474428124 0.2882613896 0.0102437572
##  [21] 0.8897227643 0.0998385579 0.9765785441 0.6263110095 0.8189663987
##  [26] 0.8142171314 0.2289382669 0.3933451127 0.9630645688 0.1585229489
##  [31] 0.3653627359 0.8156728500 0.1604756210 0.3250754566 0.9560772402
##  [36] 0.2218299413 0.2403588612 0.6548423267 0.8333722104 0.2233174085
##  [41] 0.5673194607 0.6456432254 0.0465932356 0.1668617709 0.0956007408
##  [46] 0.2807086881 0.2743727185 0.3060213479 0.4662361774 0.7148338449
##  [51] 0.8190107290 0.4139657072 0.0334808941 0.1631714739 0.6145221728
##  [56] 0.6255910993 0.9879692337 0.5909557175 0.2919432321 0.8480136376
##  [61] 0.2396267867 0.2271126616 0.0140372261 0.2352089230 0.3484869979
##  [66] 0.7520098684 0.3978046870 0.1736333375 0.1154108711 0.0966818000
##  [71] 0.7729893238 0.5798524946 0.5923610253 0.3171202319 0.2654884034
##  [76] 0.7360402378 0.7254672160 0.8663905747 0.7741213529 0.0413182371
##  [81] 0.7172160284 0.6180823920 0.0251395968 0.9586153277 0.2370699421
```

```
##  [86] 0.1578509451 0.9192689520 0.3734502334 0.6125246426 0.5803679214
##  [91] 0.0404882729 0.6060245500 0.2533204837 0.6174646146 0.6709800093
##  [96] 0.4986784160 0.5396321670 0.6206036371 0.7436010945 0.7073883556
## [101] 0.8810440945 0.1403651948 0.0095803072 0.6410322264 0.9191053398
## [106] 0.9689641173 0.1570933873 0.4948440322 0.4536333787 0.2113605556
## [111] 0.8035114724 0.5228704978 0.5376669175 0.9227446702 0.9753406069
## [116] 0.2237336703 0.3711161797 0.0353129525 0.3222257327 0.1571450704
## [121] 0.1685013452 0.0638064316 0.4893020147 0.9682556493 0.4745871460
## [126] 0.2694554001 0.4516987344 0.2202123308 0.9867946801 0.7751187934
## [131] 0.6587832973 0.0880496269 0.8152278706 0.7439878148 0.0836194784
## [136] 0.4659152231 0.7591692442 0.8864776315 0.6038413683 0.1559114396
## [141] 0.7475329281 0.6899246653 0.9861639573 0.5126079635 0.3113563182
## [146] 0.6440915293 0.8044008203 0.1331510283 0.7577468259 0.4200751849
## [151] 0.9882166183 0.5940190239 0.1337920092 0.1093714633 0.4527440837
## [156] 0.4870031353 0.4772156312 0.6883584394 0.1238144503 0.1765312739
## [161] 0.0513233980 0.6495025042 0.6077275414 0.5147005529 0.2526203436
## [166] 0.0743994124 0.0132462864 0.8147595294 0.7346024157 0.9882323125
## [171] 0.7914368890 0.0421418818 0.4482217485 0.9431283800 0.3041717457
## [176] 0.3037171357 0.2458586334 0.1390944780 0.9930689118 0.0179640960
## [181] 0.6333474671 0.3473129433 0.3848697122 0.0925622813 0.3150161311
## [186] 0.3367951058 0.0606662470 0.8249456959 0.8221009444 0.2811661591
## [191] 0.9516206449 0.2198111697 0.3371348912 0.4664305942 0.0453822589
## [196] 0.5599722816 0.3349301305 0.2032854704 0.8286181735 0.6925395546
## [201] 0.9271206164 0.8221291730 0.9972034085 0.6973466040 0.5169499926
## [206] 0.5990863321 0.3223969345 0.4964734735 0.4476255970 0.5216260178
## [211] 0.7556086318 0.3205462527 0.9506412528 0.2985267481 0.0569786283
## [216] 0.0003940333 0.9927308816 0.7886940781 0.5844371154 0.2674444148
## [221] 0.3897148769 0.3091349881 0.0609547086 0.7870363081 0.0268985992
## [226] 0.3048943724 0.1436142863 0.6270551153 0.9310787276 0.1233180955
## [231] 0.9694899826 0.9042756297 0.4780196615 0.9997890533 0.1102453312
## [236] 0.8979925164 0.6166725135 0.8766021957 0.4819052627 0.6744408454
## [241] 0.6150198269 0.5775543137 0.7899192325 0.3725320750 0.1857498381
## [246] 0.2536579652 0.7994820816 0.0724229221 0.4911580693 0.8653213726
## [251] 0.7921922009 0.7603564074 0.7658275897 0.2609684896 0.4687628602
## [256] 0.2254378458 0.8437963750 0.5267864007 0.6994121750 0.2194651333
## [261] 0.1764618107 0.3986164399 0.2646194524 0.0251766567 0.0470231422
## [266] 0.1683996238 0.4098842982 0.0107868451 0.4487984118 0.5636629767
## [271] 0.1780302855 0.0754295127 0.6989828863 0.0783133446 0.5562564055
## [276] 0.4407939913 0.5425982976 0.2262612802 0.4214579179 0.6611826962
## [281] 0.7319047865 0.4298188754 0.8704783071 0.3572077535 0.3513338610
## [286] 0.6648822455 0.7005042701 0.8147210029 0.3996182922 0.4515349315
## [291] 0.2052623765 0.2991150464 0.7789198267 0.8251774590 0.2134868747
## [296] 0.5609124941 0.9681383334 0.8594777016 0.9657609260 0.0412506310
## [301] 0.7548311418 0.4755594810 0.0729731962 0.0331127706 0.5713228611
## [306] 0.2930599167 0.8516822257 0.1701295599 0.3760239882 0.6877743497
## [311] 0.9270636514 0.5851917360 0.8916449999 0.9579640331 0.9715138061
## [316] 0.0018148751 0.9867867955 0.2682508330 0.1255420763 0.6653894021
## [321] 0.6639811567 0.0419312005 0.6743365913 0.2804404830 0.3287259294
## [326] 0.2378482595 0.0931047192 0.9018054479 0.1877670337 0.0448879760
## [331] 0.4912957121 0.7039545635 0.2069241672 0.1909614610 0.5143850462
## [336] 0.0790889347 0.8782816182 0.9176112625 0.7554454068 0.5667540238
## [341] 0.0503111489 0.5667534743 0.6279647511 0.3004350450 0.6171553163
## [346] 0.1975540451 0.6387072350 0.9078744042 0.3736896049 0.1981965557
## [351] 0.8907989997 0.1360701858 0.8814244869 0.2171411105 0.3125700054
```

```
## [356] 0.4010509730 0.1826840122 0.5822353936 0.6359907584 0.0989283440
## [361] 0.6765615689 0.1485178072 0.3771007759 0.5530016017 0.3617152253
## [366] 0.1802198892 0.6171681150 0.8206919797 0.6106209494 0.6188949822
## [371] 0.1965838522 0.7399326509 0.4477081764 0.8405267783 0.7720598341
## [376] 0.4463721714 0.2442423559 0.4129812869 0.9434902302 0.4571786132
## [381] 0.3632806947 0.8853263238 0.9804098252 0.2628147874 0.4995117523
## [386] 0.0783771609 0.9786627586 0.7474930072 0.9742306971 0.6519231112
## [391] 0.5787591410 0.8504999247 0.1858147094 0.5311700099 0.3757693039
## [396] 0.0710409759 0.1168735998 0.2629899543 0.0945292274 0.7763616967
```

```
Carseats<-Carseats[order(gp),]
Carseats
```

```
##     Sales CompPrice Income Advertising Population Price ShelveLoc Age Education
## 216  2.34       116     83          15        170   144       Bad  71        11
## 316  6.39       131     21           8        220   171      Good  29        14
## 103  5.30       113     22           0         57    97    Medium  65        16
## 20   8.73       129     76          16         58   121    Medium  69        12
## 268  5.83       134     82           7        473   112       Bad  51        12
## 167  6.71       119     67          17        151   137    Medium  55        11
## 63   1.82       139     45           0        146   133       Bad  77        17
## 17   7.58       118     32           0        284   110      Good  63        13
## 180  7.78       144     25           3         70   116    Medium  77        18
## 83  11.62       151     83           4        325   139      Good  28        17
## 264  7.77       116     26           6        434   115    Medium  25        17
## 225  4.10       134     82           0        464   141    Medium  48        13
## 304 10.01       133     52          16        290    99    Medium  43        11
## 53   7.91       153     40           3        112   129       Bad  39        18
## 118  8.80       145     53           0        507   119    Medium  41        12
## 91   5.33       115     22           0        491   103    Medium  64        11
## 300  9.40       135     40          17        497    96    Medium  54        17
## 80   9.14       134     67           0        286    90       Bad  41        13
## 322  7.52       123     39           5        499    98    Medium  34        15
## 172 12.49        93    106          12        416    55    Medium  75        15
## 330 11.27       100     54           9        433    89      Good  45        12
## 195  7.23       112     98          18        481   128    Medium  45        11
## 43  10.43        77     69           0         25    24    Medium  50        18
## 265  6.95       128     29           5        324   159      Good  31        15
## 341  7.50       140     29           0        105    91       Bad  43        16
## 161  4.67       111     28           0        486   111    Medium  29        12
## 215  4.83       115    115           3         48   107    Medium  73        18
## 187  8.68       120     51           0         93    86    Medium  46        17
## 223  7.49       136    119           6        178   145    Medium  35        13
## 122 11.67       125     89          10        380    87       Bad  28        10
## 396 12.57       138    108          17        203   128      Good  33        14
## 248  5.04       123    114           0        298   151       Bad  34        16
## 303  5.28       108     77          13        388   110       Bad  74        14
## 166  0.37       147     58           7        100   191       Bad  27        15
## 272  4.55       111     56           0        504   110    Medium  62        16
## 274 10.04       116    106           8        244    86    Medium  58        12
## 386  5.87       131     73          13        455   132    Medium  62        17
## 336  6.18       120     70          15        464   110    Medium  72        15
## 14  10.96       115     28          11         29    86      Good  53        18
## 135  3.67       132     31           0        327   131    Medium  76        16
```

```
## 132  6.50       108     69           3        208    94    Medium  77         16
## 184  5.32       118     74           6        426   102    Medium  80         18
## 327  4.69       133     30           0        152   122    Medium  53         17
## 399  5.94       100     79           7        284    95       Bad  50         12
## 45   4.16        85     79           6        325    95    Medium  69         13
## 70   7.99       127     59           0        339    99    Medium  65         12
## 360  3.13       130     62          11        396   130       Bad  66         14
## 22  12.13       134     29          12        239   109      Good  62         18
## 154  5.93       150     36           7        488   150    Medium  25         17
## 235  9.43       115     62          11        289   129      Good  56         16
## 69  13.39       149     69          20        366   134      Good  60         13
## 397  6.14       139     23           3         37   120    Medium  55         11
## 230 11.19        98    104           0        404    72    Medium  27         18
## 159 12.53       142     90           1        189   112      Good  39         10
## 319 10.08       116     72          10        456   130      Good  41         14
## 148 10.51       140     54           9        402   119      Good  41         16
## 153  7.64       128     78           0        341   128      Good  45         13
## 13   3.98       122     35           2        393   136    Medium  62         18
## 352 10.44       124    115          16        458   105    Medium  62         16
## 178 10.48       138     72           0        148    94    Medium  27         17
## 102  6.20       128     93           0         89   118    Medium  34         18
## 227  7.80       119     33           0        245   122      Good  56         14
## 362  8.68       131     25          10        183   104    Medium  56         15
## 140 12.30       146     62          10        310    94    Medium  30         13
## 107  0.16       102     33           0        217   139    Medium  70         18
## 120  7.37       130     94           8        137   128    Medium  64         12
## 86   8.47       125    103           0        304   112    Medium  49         13
## 30   7.81       104     99          15        226   102       Bad  58         17
## 33   6.20       107     32          12        236   137      Good  64         10
## 54   6.92       109     64          13         39   119    Medium  61         17
## 44   4.12       123     42          11         16   134    Medium  59         13
## 266  5.31       130     35          10        402   129       Bad  39         17
## 121  6.87       128    105          11        249   131    Medium  63         13
## 308  5.90       138     92           0         13   120       Bad  61         12
## 68   9.01       126     61          14        152   115    Medium  47         16
## 261  7.67       129    117           8        400   101       Bad  36         10
## 160  9.32       119     60           0        372    70       Bad  30         18
## 271 11.99       119     26           0        284    89      Good  26         10
## 7    6.63       115    105           0         45   108    Medium  71         15
## 366  6.53       154     30           0        122   162    Medium  57         17
## 357  3.58       142    109           0        111   164      Good  72         12
## 245  8.78       130     30           0        391   100    Medium  26         18
## 393  4.53       129     42          13        315   130       Bad  34         13
## 329  3.15       117     66           1         65   111       Bad  55         11
## 334  5.87       136     60           7        303   147    Medium  41         10
## 371  7.68       126     41          22        403   119       Bad  42         12
## 346  4.81       121     68           0        279   149      Good  79         12
## 350  9.32       134     27          18        467    96    Medium  49         14
## 198  2.52       124     61           0        333   138    Medium  76         16
## 291  9.49       107    111          14        400   103    Medium  41         11
## 333  5.74       106     33          20        354   104    Medium  61         12
## 110  8.98       115     65           0        217    90    Medium  60         17
## 295 12.66       148     76           3        126    99      Good  60         11
## 354  9.45       107     67          12        430    92    Medium  35         12
```

```
## 260  5.12       123     36          10        467   100       Bad  74        11
## 192  6.67       156     42          13        170   173      Good  74        14
## 128  6.52       125     48           3        192   116    Medium  51        14
## 36  11.07       131     84          11         29    96    Medium  44        17
## 40   3.24       130     60           0        144   138       Bad  38        10
## 116  8.54       139     35           0         95   129    Medium  42        13
## 256  7.71       123     81           8        198    81       Bad  80        15
## 278  7.80       136     48          12        326   125    Medium  36        16
## 62   7.32       105     32           0        358   107    Medium  26        13
## 27   8.33       107    115          11        496   131      Good  50        11
## 64   8.47       119     88          10        170   101    Medium  61        13
## 85   2.23       111     25           0         52   121       Bad  43        18
## 326 11.70       144     69          11        131   104    Medium  47        11
## 61   8.32       122    102          19        469   123       Bad  29        13
## 37   8.89       122     76           0        270   100      Good  60        18
## 377 16.27       141     60          19        319    92      Good  44        11
## 177  5.61       138    107           9        480   154    Medium  47        11
## 165  8.22       148     64           0         58   141    Medium  27        13
## 93   4.53       114    113           0         97   125    Medium  29        12
## 246 10.00       114     43           0        199    88      Good  57        10
## 254  5.64       124     24           5        288   122    Medium  57        12
## 384  9.35        98    117           0         76    68    Medium  63        10
## 398  7.41       162     26          12        368   159    Medium  40        18
## 263  6.37       120     77          15         86   132    Medium  48        18
## 75   6.20       150     68           5        125   136    Medium  64        13
## 220 10.62       116     79          19        359   116      Good  58        17
## 318  6.41       142     30           0        472   136      Good  80        15
## 126  9.34        89     78           0        181    49    Medium  43        15
## 47  12.44       127     90          14         16    70    Medium  48        15
## 324 10.36       107    105          18        428   103    Medium  34        12
## 46   4.56       141     63           0        168   135       Bad  44        12
## 190 12.11       118    117          18        509   104    Medium  26        15
## 19  13.91       110    110           0        408    68      Good  46        17
## 59   5.42       103     93          15        188   103       Bad  74        16
## 306  8.03       115     29          26        394   132    Medium  33        13
## 9    6.54       132    110           0        108   124    Medium  76        10
## 214  8.23       149     84           5        220   139    Medium  33        10
## 292  6.64       118     70           0        106    89       Bad  39        17
## 344  5.99       117     42          10        371   121       Bad  26        14
## 176  7.54       115     89           0         38   122    Medium  25        12
## 175  0.00       139     24           0        358   185    Medium  79        15
## 226  6.68       107     25           0        412    82       Bad  36        14
## 48   4.38       126     98           0        173   108       Bad  55        16
## 222  6.43       124     44           0        125   107    Medium  80        11
## 145  9.09       132     68           0        264   123      Good  34        11
## 355  5.30       133     31           1         80   145    Medium  42        18
## 185  9.95       132     33           7         35    97    Medium  60        11
## 74  12.61       118     90          10         54   104      Good  31        11
## 212  9.39       117    118          14        445   120    Medium  32        15
## 119  7.57       112     88           2        243    99    Medium  62        11
## 207  4.97       162     67           0         27   160    Medium  77        17
## 34   8.77       114     38          13        317   128      Good  50        16
## 325  2.66       136     65           4        133   150       Bad  53        13
## 5    4.15       141     64           3        340   128       Bad  38        13
```

```
## 197  4.10       130     28           6        410   133       Bad  72        16
## 186 10.07       130    100          11        449   107    Medium  64        10
## 193  7.56       108     26           0        408    93    Medium  56        14
## 182  7.43       121     83           0         79    91    Medium  68        11
## 65   7.80       100     67          12        184   104    Medium  32        16
## 285  6.97       106     46          11        414    96       Bad  79        17
## 284  5.36       135    110           0        112   117    Medium  80        16
## 365 10.50       122     21          16        488   131      Good  30        14
## 381  9.64       106     64          10         17    89    Medium  68        17
## 31  13.55       125     94           0        447    89      Good  30        12
## 117  5.08       135     75           0        202   128    Medium  80        10
## 244  7.82       124     25          13         87   110    Medium  57        10
## 88  11.70       131     67           7        272   126      Good  54        16
## 349 12.57       132    102          20        459   107      Good  49        11
## 395  5.35       130     58          19        366   139       Bad  33        16
## 309  9.24       126     80          19        436   126    Medium  52        10
## 363  5.25       131     55           0         26   110       Bad  79        12
## 183  4.74       137     60           4        230   140       Bad  25        13
## 221 10.59       131    120          15        262   124    Medium  30        10
## 28   5.27        98    118           0         19   107    Medium  64        17
## 67   8.85       127     92           0        508    91    Medium  56        18
## 262  5.71       121     42           4        188   118    Medium  54        15
## 289  6.98       116     40           0         74    97    Medium  76        15
## 356  7.02       130    100           0        306   146      Good  42        11
## 267  9.10       128     93          12        343   112      Good  73        17
## 378  6.81       132     61           0        263   125    Medium  41        12
## 52   4.42       121     90           0        150   108       Bad  75        16
## 150 11.48       121    120          13        140    87    Medium  56        11
## 279  7.22       114    113           2        129   151      Good  40        15
## 282 11.19       122     69           7        303   105      Good  45        16
## 4    7.40       117    100           4        466    97    Medium  55        14
## 276  6.67       107    119          11        210   132    Medium  53        11
## 376  7.90       132     46           4        206   124    Medium  73        11
## 209  7.78        86     54           0        497    64       Bad  33        12
## 373  7.80       121     50           0        508    98    Medium  65        11
## 173  9.03       104    102          13        123   110      Good  35        16
## 269  6.53       123     57           0         66   105    Medium  39        11
## 290  8.75       143     77          25        448   156    Medium  43        17
## 127 11.27       153     68           2         60   133      Good  59        16
## 155  6.89       129     69          10        289   110    Medium  50        16
## 109  3.47       107     79           2        488   103       Bad  65        16
## 380  5.81       125    111           0        404   107       Bad  54        15
## 136  6.44        96     94          14        384   120    Medium  36        18
## 49   3.91       116     52           0        349    98       Bad  69        18
## 194 13.28       139     70           7         71    96      Good  61        10
## 255  9.58       108    104          23        353   129      Good  37        17
## 125  8.87       131    113           0        181   120      Good  63        14
## 302  7.41        99     93           0        198    87    Medium  57        16
## 157  7.49       146     34           0        220   157      Good  51        16
## 233 13.14       137     80          10         24   105      Good  61        15
## 8   11.85       136     81          15        425   120      Good  67        10
## 239  7.36       121     24           0        200   133      Good  73        13
## 156  7.71        98     72           0         59    69    Medium  65        16
## 123  6.88       119    100           5         45   108    Medium  75        10
```

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## 249  5.36       111     52           0         12   101    Medium  61        11
## 331  4.99       122     59           0        501   112       Bad  32        14
## 108  8.55       134    107           0        104   108    Medium  60        12
## 208  8.19       111    105           0        466    97       Bad  61        10
## 96   5.58       134     25          10        237   148    Medium  59        13
## 385 12.85       123     37          15        348   112      Good  28        12
## 144  0.53       122     88           7         36   159       Bad  28        17
## 335  7.63        93    117           9        489    83       Bad  42        13
## 164  5.68       130     64           0         40   106       Bad  39        17
## 205  8.74       155     80           0        237   124    Medium  37        14
## 210  3.02        98     21          11        326    90       Bad  76        11
## 112  6.62       132    118          12        272   151    Medium  43        14
## 258  8.67       125     62          14        477   112    Medium  80        13
## 16   8.71       149     95           5        400   144    Medium  76        18
## 394  5.57       109     51          10         26   120    Medium  30        17
## 113  6.67       116     99           5        298   125      Good  62        12
## 97   9.48       147     42          10        407   132      Good  73        16
## 277  6.93       135     69          14        296   130    Medium  73        15
## 364 10.26       111     75           1        377   108      Good  25        12
## 275  7.22       135     93           2         67   119    Medium  34        11
## 196  4.19       117     93           4        420   112       Bad  66        11
## 296  4.21       118     35          14        502   137    Medium  79        10
## 270  5.01       159     69           0        438   166    Medium  46        17
## 342  7.38        98    120           0        268    93    Medium  72        10
## 340 11.54       134     44           4        219   126      Good  44        15
## 41   2.07       119     98           0         18   126       Bad  73        17
## 305 11.93       123     98          12        408   134      Good  29        10
## 242 12.01       136     63           0        160    94    Medium  38        12
## 391  5.47       108     75           9         61   111    Medium  67        12
## 72   6.50       148     51          16        148   150    Medium  58        17
## 90   7.95       128     66           3        493   119    Medium  45        16
## 358 13.36       103     73           3        276    72    Medium  34        15
## 219  9.70       138     61          12        156   120    Medium  25        14
## 312  6.15       146     68          12        328   132       Bad  51        14
## 58   0.91        93     91           0         22   117       Bad  75        11
## 73   5.52       115     45           0        432   116    Medium  25        15
## 152 10.77       111     58          17        407   103      Good  75        17
## 206  5.68       113     22           1        317   132    Medium  28        12
## 139 10.27       125    103          12        371   109    Medium  44        10
## 92   4.81        97     46          11        267   107    Medium  80        15
## 163  3.63       122     74           0        424   149    Medium  51        13
## 369 10.71       109     22          10        348    79      Good  74        14
## 89   6.56       117     42           7        144   111    Medium  62        10
## 55   4.90       134    103          13         25   144    Medium  76        17
## 241 10.31       159     80           0        362   121    Medium  26        18
## 237  9.32       141     34          16        361   108    Medium  69        10
## 345  8.43       138     80           0        108   126      Good  70        13
## 367  5.98       124     56          11        447   134    Medium  53        12
## 94   8.86       145     30           0         67   104    Medium  55        17
## 82   7.52       116     72           0        237   128      Good  70        13
## 370 10.26       135    100          22        463   122    Medium  36        14
## 98   7.45       161     82           5        287   129       Bad  33        16
## 56   6.85       143     81           5         60   154    Medium  61        18
## 24   5.87       121     31           0        292   109    Medium  79        10
```

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## 228  8.69       113     64          10         68   101    Medium  57        16
## 343  7.81       137    102          13        422   118    Medium  71        10
## 15  11.17       107    117          11        148   118      Good  52        18
## 181  4.94       137    112          15        434   149       Bad  66        13
## 359  4.17       123     96          10         71   118       Bad  69        11
## 347  8.97       132    107           0        144   125    Medium  33        13
## 104  5.07       123     91           0        334    96       Bad  78        17
## 146  8.77       144     63          11         27   117    Medium  47        17
## 42   7.96       157     53           0        403   124       Bad  58        16
## 162  2.93       143     21           5         81   160    Medium  67        12
## 390  8.44       128     42           8        328   107    Medium  35        12
## 3   10.06       113     35          10        269    80    Medium  59        12
## 38   4.95       121     41           5        412   110    Medium  54        10
## 131  8.41        94     84          13        497    77    Medium  51        12
## 280  3.42       141     57          13        376   158    Medium  64        18
## 321  5.86       136     70          12        171   152    Medium  44        18
## 10   4.69       132    113           0        131   124    Medium  76        17
## 286  7.60       146     26          11        261   131    Medium  39        10
## 320  6.97       127     45          19        459   129    Medium  57        11
## 95   8.39       115     97           5        134    84       Bad  55        11
## 323  9.16       140     50          10        300   139      Good  60        15
## 240  3.89       123    105           0        149   118       Bad  62        16
## 361  8.77       118     86           7        265   114      Good  52        15
## 310 11.18       131    111          13         33    80       Bad  68        18
## 158 10.21       121     58           8        249    90    Medium  48        13
## 142  6.53       140     42           0        331   131       Bad  28        15
## 200  6.42       122     88           5        335   126    Medium  64        14
## 204  2.05       131     82           0        132   157       Bad  25        14
## 273 12.98       113     33           0         14    63      Good  38        12
## 259  3.47       108     38           0        251    81       Bad  72        14
## 287  7.53       117    118          11        429   113    Medium  67        18
## 332 10.10       135     63          15        213   134    Medium  32        10
## 100  4.88       121     47           3        220   107       Bad  56        16
## 11   9.01       121     78           9        150   100       Bad  26        10
## 50  10.61       157     93           0         51   149      Good  32        17
## 81   8.01       113    100          16        353    79       Bad  68        11
## 77  10.64       102     87          10        346    70    Medium  64        15
## 281  2.86       121     86          10        496   145       Bad  51        10
## 169  7.30       129     89           0        425   117    Medium  45        10
## 76   8.55        88    111          23        480    92       Bad  36        16
## 372  9.08       152     81           0        191   126    Medium  54        16
## 99  12.49       122     77          24        382   127      Good  36        16
## 134  7.62       132     98           2        265    97       Bad  62        12
## 388  8.67       142     73          14        238   115    Medium  73        14
## 141  6.03       133     60          10        277   129    Medium  45        18
## 1    9.50       138     73          11        276   120       Bad  42        17
## 66   4.90       122     26           0        197   128    Medium  55        13
## 301  8.57       116     78           1        158    99    Medium  45        11
## 339  5.97       112     24           0        164   101    Medium  45        11
## 211  4.36       125     41           2        357   123       Bad  47        14
## 149  7.56       110    119           0        384    97    Medium  72        14
## 137  5.17       131     75           0         10   120       Bad  31        18
## 252  3.72       139    111           5        310   132       Bad  62        13
## 253  8.31       133     97           0         70   117    Medium  32        16
```

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## 375  9.44       131     47           7         90   118    Medium  47        12
## 71   9.46        89     81          15        237    99      Good  74        12
## 79   4.43       134     48           1        139   145    Medium  65        12
## 130  4.47       143    120           7        279   147       Bad  40        10
## 400  9.71       134     37           0         27   120      Good  49        16
## 293 11.82       113     66          16        322    74      Good  76        15
## 12  11.96       117     94           4        503    94      Good  50        13
## 224  3.45       110     45           9        276   125    Medium  62        14
## 218  4.34       106     44           0        481   111    Medium  70        14
## 243  4.68       124     46           0        199   135    Medium  52        14
## 171  8.01       128     39          12        356   118    Medium  71        10
## 251  9.16       137    105          10        435   156      Good  72        14
## 247  6.90       120     56          20        266    90       Bad  78        18
## 111  9.00       128     62           7        125   116    Medium  43        14
## 147  3.90       114     83           0        412   131       Bad  39        14
## 26  14.90       139     32           0        176    82      Good  54        11
## 288  6.88        95     44           4        208    72       Bad  44        17
## 168  6.71       106     73           0        216    93    Medium  60        13
## 133  9.54       125     87           9        232   136      Good  72        10
## 32   8.25       136     58          16        241   131    Medium  44        18
## 25  10.14       145    119          16        294   113       Bad  42        12
## 51   1.42        99     32          18        341   108       Bad  80        16
## 368 14.37        95    106           0        256    53      Good  52        17
## 189  8.07       116     37           0        426    90    Medium  76        15
## 202  5.94       138     83           0        139   134    Medium  54        18
## 188  6.03       117     32           0        142    96       Bad  62        17
## 294 11.28       123     84           0         74    89      Good  59        10
## 199  3.62       112     80           5        500   128    Medium  69        10
## 39   6.59       109     73           0        454   102    Medium  65        15
## 374  5.58       137     71           0        402   116    Medium  78        17
## 257  4.20       147     40           0        277   144    Medium  73        10
## 60   5.21       118     71           4        148   114    Medium  80        13
## 392  6.10       153     63           0         49   124       Bad  56        16
## 307  4.78       131     32           1         85   133    Medium  48        12
## 298  3.07       118     83          13        276   104       Bad  75        10
## 250  5.05       125     67           0         86   117       Bad  65        11
## 6   10.81       124    113          13        501    72       Bad  78        16
## 78   7.70       118     71          12         44    89    Medium  67        18
## 283  7.74       150     96           0         80   154      Good  61        11
## 238  9.62       151     28           8        499   135    Medium  48        10
## 337  5.17       138     35           6         60   143       Bad  28        18
## 101  4.11       113     69          11         94   106    Medium  76        12
## 353 13.44       133    103          14        288   122      Good  61        17
## 382  3.90       124     65          21        496   151       Bad  77        13
## 138  6.52       128     42           0        436   118    Medium  80        11
## 21   6.41       125     90           2        367   131    Medium  35        18
## 351  8.64       111    101          17        266    91    Medium  63        17
## 313  6.80       137    117           5        337   135       Bad  38        10
## 236  5.53       126     32           8         95   132    Medium  50        17
## 328  6.23       112     38          17        316   104    Medium  80        16
## 232  8.09       132     69           0        123   122    Medium  27        11
## 348  6.88        96     39           0        161   112      Good  27        14
## 338  8.61       130     38           0        283   102    Medium  80        15
## 105  4.62       121     96           0        472   138    Medium  51        12
```

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## 87   8.70       150     84           9        432   134    Medium  64        15
## 114  6.01       131     29          11        335   127       Bad  33        12
## 311  9.53       175     65          29        419   166    Medium  53        12
## 201  5.56       144     92           0        349   146    Medium  62        12
## 229  5.40       149     73          13        381   163       Bad  26        11
## 174  6.38       135     91           5        207   128    Medium  66        18
## 379  6.11       133     88           3        105   119    Medium  79        12
## 18  12.29       147     74          13        251   131      Good  52        10
## 213 12.04       145     69          19        501   105    Medium  45        11
## 191  8.79       130     37          13        297   101    Medium  37        13
## 35   2.67       115     54           0        406   128    Medium  42        17
## 314  9.33       103     81           3        491    54    Medium  66        13
## 84   4.42       109     36           7        468    94       Bad  56        11
## 29   2.99       103     74           0        359    97       Bad  55        11
## 299 10.98       148     63           0        312   130      Good  63        15
## 297  8.21       127     44          13        160   123      Good  63        18
## 124  8.19       127    103           0        125   155      Good  29        15
## 106  5.55       104    100           8        398    97    Medium  61        11
## 231  5.16       115     60           0        119   114       Bad  38        14
## 315  7.72       133     33          10        333   129      Good  71        14
## 389  8.14       135     89          11        245    78       Bad  79        16
## 115  9.31       122     87           9         17   106    Medium  65        13
## 23   5.08       128     46           6        497   138    Medium  42        13
## 387  5.32       152    116           0        170   160    Medium  39        16
## 383  4.95       121     28          19        315   121    Medium  66        14
## 143  7.44       124     84           0        300   104    Medium  77        15
## 317 15.63       122     36           5        369    72      Good  35        10
## 129  4.96       133    100           3        350   126       Bad  55        13
## 57  11.91       133     82           0         54    84    Medium  50        17
## 151 10.49       122     84           8        176   114      Good  57        10
## 170 11.48       104     41          15        492    77      Good  73        18
## 217  5.73       141     33           0        243   144    Medium  34        17
## 179 10.66       104     71          14         89    81    Medium  25        14
## 2   11.22       111     48          16        260    83      Good  65        10
## 203  4.10       121     78           4        413   130       Bad  46        10
## 234  8.65       123     76          18        218   120    Medium  29        14
##     Urban  US
## 216   Yes Yes
## 316   Yes Yes
## 103    No  No
## 20    Yes Yes
## 268    No Yes
## 167   Yes Yes
## 63    Yes Yes
## 17    Yes  No
## 180   Yes Yes
## 83    Yes Yes
## 264   Yes Yes
## 225    No  No
## 304   Yes Yes
## 53    Yes Yes
## 118   Yes  No
## 91     No  No
## 300    No Yes
```

```
## 80    Yes  No
## 322   Yes  No
## 172   Yes Yes
## 330   Yes Yes
## 195   Yes Yes
## 43    Yes  No
## 265   Yes Yes
## 341   Yes  No
## 161    No  No
## 215   Yes Yes
## 187    No  No
## 223   Yes Yes
## 122   Yes Yes
## 396   Yes Yes
## 248   Yes  No
## 303   Yes Yes
## 166   Yes Yes
## 272   Yes  No
## 274   Yes Yes
## 386   Yes Yes
## 336   Yes Yes
## 14    Yes Yes
## 135   Yes  No
## 132   Yes  No
## 184   Yes Yes
## 327   Yes  No
## 399   Yes Yes
## 45    Yes Yes
## 70    Yes  No
## 360   Yes Yes
## 22     No Yes
## 154    No Yes
## 235    No Yes
## 69    Yes Yes
## 397    No Yes
## 230    No  No
## 159    No Yes
## 319    No Yes
## 148    No Yes
## 153    No  No
## 13    Yes  No
## 352    No Yes
## 178   Yes Yes
## 102   Yes  No
## 227   Yes  No
## 362    No Yes
## 140    No Yes
## 107    No  No
## 120   Yes Yes
## 86     No  No
## 30    Yes Yes
## 33     No Yes
## 54    Yes Yes
## 44    Yes Yes
```

```
## 266   Yes Yes
## 121   Yes Yes
## 308   Yes  No
## 68    Yes Yes
## 261   Yes Yes
## 160    No  No
## 271   Yes  No
## 7     Yes  No
## 366    No  No
## 357   Yes  No
## 245   Yes  No
## 393   Yes Yes
## 329   Yes Yes
## 334   Yes Yes
## 371   Yes Yes
## 346   Yes  No
## 350    No Yes
## 198   Yes  No
## 291    No Yes
## 333   Yes Yes
## 110    No  No
## 295   Yes Yes
## 354    No Yes
## 260    No Yes
## 192   Yes Yes
## 128   Yes Yes
## 36     No Yes
## 40     No  No
## 116   Yes  No
## 256   Yes Yes
## 278   Yes Yes
## 62     No  No
## 27     No Yes
## 64    Yes Yes
## 85     No  No
## 326   Yes Yes
## 61    Yes Yes
## 37     No  No
## 377   Yes Yes
## 177    No Yes
## 165    No Yes
## 93    Yes  No
## 246    No Yes
## 254    No Yes
## 384   Yes  No
## 398   Yes Yes
## 263   Yes Yes
## 75     No Yes
## 220   Yes Yes
## 318    No  No
## 126    No  No
## 47     No Yes
## 324   Yes Yes
## 46    Yes Yes
```

```
## 190    No Yes
## 19     No Yes
## 59    Yes Yes
## 306   Yes Yes
## 9      No  No
## 214   Yes Yes
## 292   Yes  No
## 344   Yes Yes
## 176   Yes  No
## 175    No  No
## 226   Yes  No
## 48    Yes  No
## 222   Yes  No
## 145    No  No
## 355   Yes Yes
## 185    No Yes
## 74     No Yes
## 212   Yes Yes
## 119   Yes Yes
## 207   Yes Yes
## 34    Yes Yes
## 325   Yes Yes
## 5     Yes  No
## 197   Yes Yes
## 186   Yes Yes
## 193    No  No
## 182   Yes  No
## 65     No Yes
## 285    No  No
## 284    No  No
## 365   Yes Yes
## 381   Yes Yes
## 31    Yes  No
## 117    No  No
## 244   Yes Yes
## 88     No Yes
## 349   Yes Yes
## 395   Yes Yes
## 309   Yes Yes
## 363   Yes Yes
## 183   Yes  No
## 221   Yes Yes
## 28    Yes  No
## 67    Yes  No
## 262   Yes Yes
## 289    No  No
## 356   Yes  No
## 267    No Yes
## 378    No  No
## 52    Yes  No
## 150   Yes Yes
## 279    No Yes
## 282    No Yes
## 4     Yes Yes
```

```
## 276   Yes Yes
## 376   Yes  No
## 209   Yes  No
## 373    No  No
## 173   Yes Yes
## 269   Yes  No
## 290   Yes Yes
## 127   Yes Yes
## 155    No Yes
## 109   Yes  No
## 380   Yes  No
## 136    No Yes
## 49    Yes  No
## 194   Yes Yes
## 255   Yes Yes
## 125   Yes  No
## 302   Yes Yes
## 157   Yes  No
## 233   Yes Yes
## 8     Yes Yes
## 239   Yes  No
## 156   Yes  No
## 123   Yes Yes
## 249   Yes Yes
## 331    No  No
## 108   Yes  No
## 208    No  No
## 96    Yes Yes
## 385   Yes Yes
## 144   Yes Yes
## 335   Yes Yes
## 164    No  No
## 205   Yes  No
## 210    No Yes
## 112   Yes Yes
## 258   Yes Yes
## 16     No  No
## 394    No Yes
## 113   Yes Yes
## 97     No Yes
## 277   Yes Yes
## 364   Yes  No
## 275   Yes Yes
## 196   Yes Yes
## 296    No Yes
## 270   Yes  No
## 342    No  No
## 340   Yes Yes
## 41     No  No
## 305   Yes Yes
## 242   Yes  No
## 391   Yes Yes
## 72     No Yes
## 90     No  No
```

```
## 358   Yes Yes
## 219   Yes Yes
## 312   Yes Yes
## 58    Yes  No
## 73    Yes  No
## 152    No Yes
## 206   Yes  No
## 139   Yes Yes
## 92    Yes Yes
## 163   Yes  No
## 369    No Yes
## 89    Yes Yes
## 55     No Yes
## 241   Yes  No
## 237   Yes Yes
## 345    No Yes
## 367    No Yes
## 94    Yes  No
## 82    Yes  No
## 370   Yes Yes
## 98    Yes Yes
## 56    Yes Yes
## 24    Yes  No
## 228   Yes Yes
## 343    No Yes
## 15    Yes Yes
## 181   Yes Yes
## 359   Yes Yes
## 347    No  No
## 104   Yes Yes
## 146   Yes Yes
## 42    Yes  No
## 162    No Yes
## 390   Yes Yes
## 3     Yes Yes
## 38    Yes Yes
## 131   Yes Yes
## 280   Yes Yes
## 321   Yes Yes
## 10     No Yes
## 286   Yes Yes
## 320    No Yes
## 95    Yes Yes
## 323   Yes Yes
## 240   Yes Yes
## 361    No Yes
## 310   Yes Yes
## 158    No Yes
## 142   Yes  No
## 200   Yes Yes
## 204   Yes  No
## 273   Yes  No
## 259    No  No
## 287    No Yes
```

```
## 332   Yes Yes
## 100    No Yes
## 11     No Yes
## 50    Yes  No
## 81    Yes Yes
## 77    Yes Yes
## 281   Yes Yes
## 169   Yes  No
## 76     No Yes
## 372   Yes  No
## 99     No Yes
## 134   Yes Yes
## 388    No Yes
## 141   Yes Yes
## 1     Yes Yes
## 66     No  No
## 301   Yes Yes
## 339   Yes  No
## 211    No Yes
## 149    No Yes
## 137    No  No
## 252   Yes Yes
## 253   Yes  No
## 375   Yes Yes
## 71    Yes Yes
## 79    Yes Yes
## 130    No Yes
## 400   Yes Yes
## 293   Yes Yes
## 12    Yes Yes
## 224   Yes Yes
## 218    No  No
## 243    No  No
## 171   Yes Yes
## 251   Yes Yes
## 247   Yes Yes
## 111   Yes Yes
## 147   Yes  No
## 26     No  No
## 288   Yes Yes
## 168   Yes  No
## 133   Yes Yes
## 32    Yes Yes
## 25    Yes Yes
## 51    Yes Yes
## 368   Yes  No
## 189   Yes  No
## 202   Yes  No
## 188   Yes  No
## 294   Yes  No
## 199   Yes Yes
## 39    Yes  No
## 374   Yes  No
## 257   Yes  No
```

```
## 60    Yes  No
## 392   Yes  No
## 307   Yes Yes
## 298   Yes Yes
## 250   Yes  No
## 6      No Yes
## 78     No Yes
## 283   Yes  No
## 238   Yes Yes
## 337   Yes  No
## 101    No Yes
## 353   Yes Yes
## 382   Yes Yes
## 138   Yes  No
## 21    Yes Yes
## 351    No Yes
## 313   Yes Yes
## 236   Yes Yes
## 328   Yes Yes
## 232    No  No
## 348    No  No
## 338   Yes  No
## 105   Yes  No
## 87    Yes  No
## 114   Yes Yes
## 311   Yes Yes
## 201    No  No
## 229    No Yes
## 174   Yes Yes
## 379   Yes Yes
## 18    Yes Yes
## 213   Yes Yes
## 191    No Yes
## 35    Yes Yes
## 314   Yes  No
## 84    Yes Yes
## 29    Yes Yes
## 299   Yes  No
## 297   Yes Yes
## 124    No Yes
## 106   Yes Yes
## 231    No  No
## 315   Yes Yes
## 389   Yes Yes
## 115   Yes Yes
## 23    Yes  No
## 387   Yes  No
## 383   Yes Yes
## 143   Yes  No
## 317   Yes Yes
## 129   Yes Yes
## 57    Yes  No
## 151    No Yes
## 170   Yes Yes
```

```
## 217   Yes  No
## 179    No Yes
## 2     Yes Yes
## 203    No Yes
## 234    No Yes
```

```
summary(Carseats)
```

```
##      Sales          CompPrice       Income        Advertising
##  Min.   : 0.000   Min.   : 77   Min.   : 21.00   Min.   : 0.000
##  1st Qu.: 5.390   1st Qu.:115   1st Qu.: 42.75   1st Qu.: 0.000
##  Median : 7.490   Median :125   Median : 69.00   Median : 5.000
##  Mean   : 7.496   Mean   :125   Mean   : 68.66   Mean   : 6.635
##  3rd Qu.: 9.320   3rd Qu.:135   3rd Qu.: 91.00   3rd Qu.:12.000
##  Max.   :16.270   Max.   :175   Max.   :120.00   Max.   :29.000
##    Population        Price        ShelveLoc        Age          Education
##  Min.   : 10.0   Min.   : 24.0   Bad   : 96   Min.   :25.00   Min.   :10.0
##  1st Qu.:139.0   1st Qu.:100.0   Good  : 85   1st Qu.:39.75   1st Qu.:12.0
##  Median :272.0   Median :117.0   Medium:219   Median :54.50   Median :14.0
##  Mean   :264.8   Mean   :115.8                Mean   :53.32   Mean   :13.9
##  3rd Qu.:398.5   3rd Qu.:131.0                3rd Qu.:66.00   3rd Qu.:16.0
##  Max.   :509.0   Max.   :191.0                Max.   :80.00   Max.   :18.0
##  Urban       US
##  No :118   No :142
##  Yes:282   Yes:258
##
##
##
##
```

```
head(Carseats)
```

```
##     Sales CompPrice Income Advertising Population Price ShelveLoc Age Education
## 216  2.34       116     83          15        170   144       Bad  71        11
## 316  6.39       131     21           8        220   171      Good  29        14
## 103  5.30       113     22           0         57    97    Medium  65        16
## 20   8.73       129     76          16         58   121    Medium  69        12
## 268  5.83       134     82           7        473   112       Bad  51        12
## 167  6.71       119     67          17        151   137    Medium  55        11
##     Urban  US
## 216   Yes Yes
## 316   Yes Yes
## 103    No  No
## 20    Yes Yes
## 268    No Yes
## 167   Yes Yes
```

```
split <- sample.split(Carseats, SplitRatio = 0.8)
train_cl <- subset(Carseats, split == "TRUE")
test_cl <- subset(Carseats, split == "FALSE")
train_scale <- scale(train_cl[, 1:4])
test_scale <- scale(test_cl[, 1:4])
```

```
classifier_knn <- knn(train = train_scale,
                      test = test_scale,
                      cl = train_cl$Urban,
                      k = 1)
cm <- table(test_cl$Urban, classifier_knn)
cm
```

```
##      classifier_knn
##       No Yes
##   No  11  18
##   Yes 22  58
```

```
misClassError <- mean(classifier_knn != test_cl$Urban)
print(paste('Accuracy =', 1-misClassError))
```

```
## [1] "Accuracy = 0.63302752293578"
```

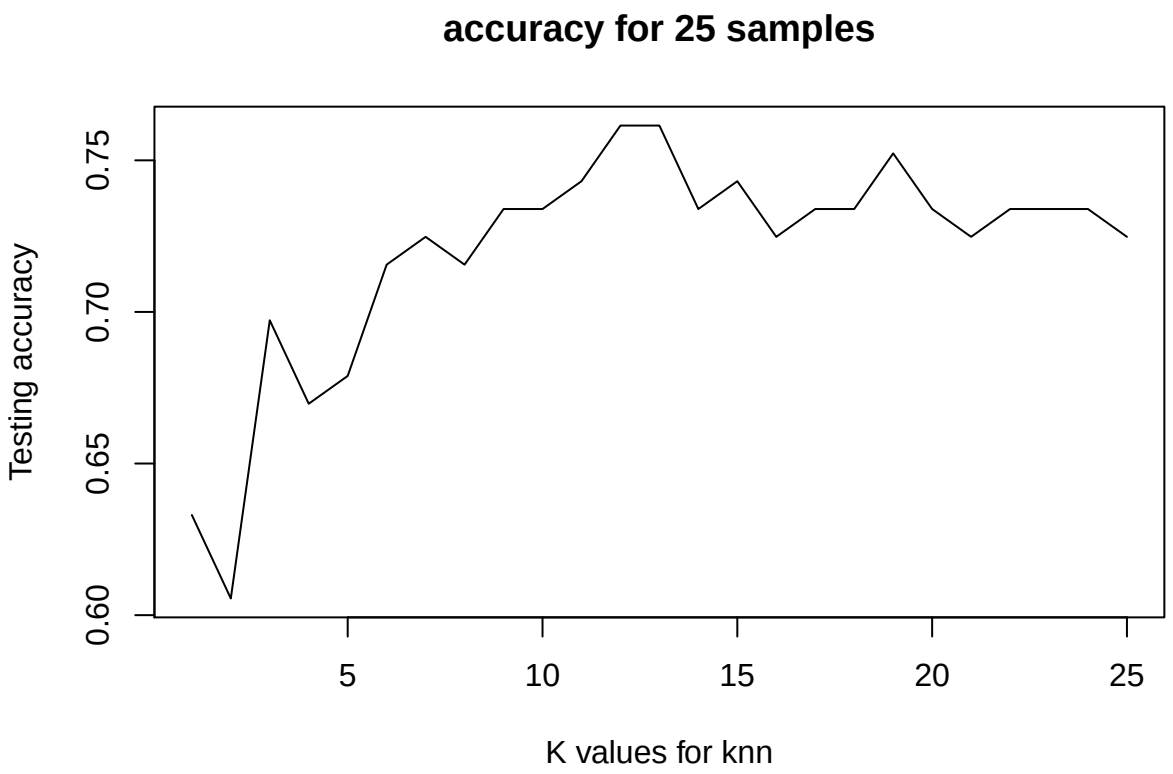
```
accuracies <- vector()
errors<-vector()
for(i in 1:25){
  print(paste("For k = ",i))
  classifier_knn <- knn(train = train_scale,
                        test = test_scale,
                        cl = train_cl$Urban,
                        k = i)
  misClassError <- mean(classifier_knn != test_cl$Urban)
  print(paste('Accuracy =', 1-misClassError))
  print(paste('error =', misClassError))
  accuracies[i] <- 1-misClassError
  errors[i]<-misClassError
}
```

```
## [1] "For k =  1"
## [1] "Accuracy = 0.63302752293578"
## [1] "error = 0.36697247706422"
## [1] "For k =  2"
## [1] "Accuracy = 0.605504587155963"
## [1] "error = 0.394495412844037"
## [1] "For k =  3"
## [1] "Accuracy = 0.697247706422018"
## [1] "error = 0.302752293577982"
## [1] "For k =  4"
## [1] "Accuracy = 0.669724770642202"
## [1] "error = 0.330275229357798"
## [1] "For k =  5"
## [1] "Accuracy = 0.678899082568807"
## [1] "error = 0.321100917431193"
## [1] "For k =  6"
## [1] "Accuracy = 0.715596330275229"
## [1] "error = 0.284403669724771"
## [1] "For k =  7"
## [1] "Accuracy = 0.724770642201835"
```

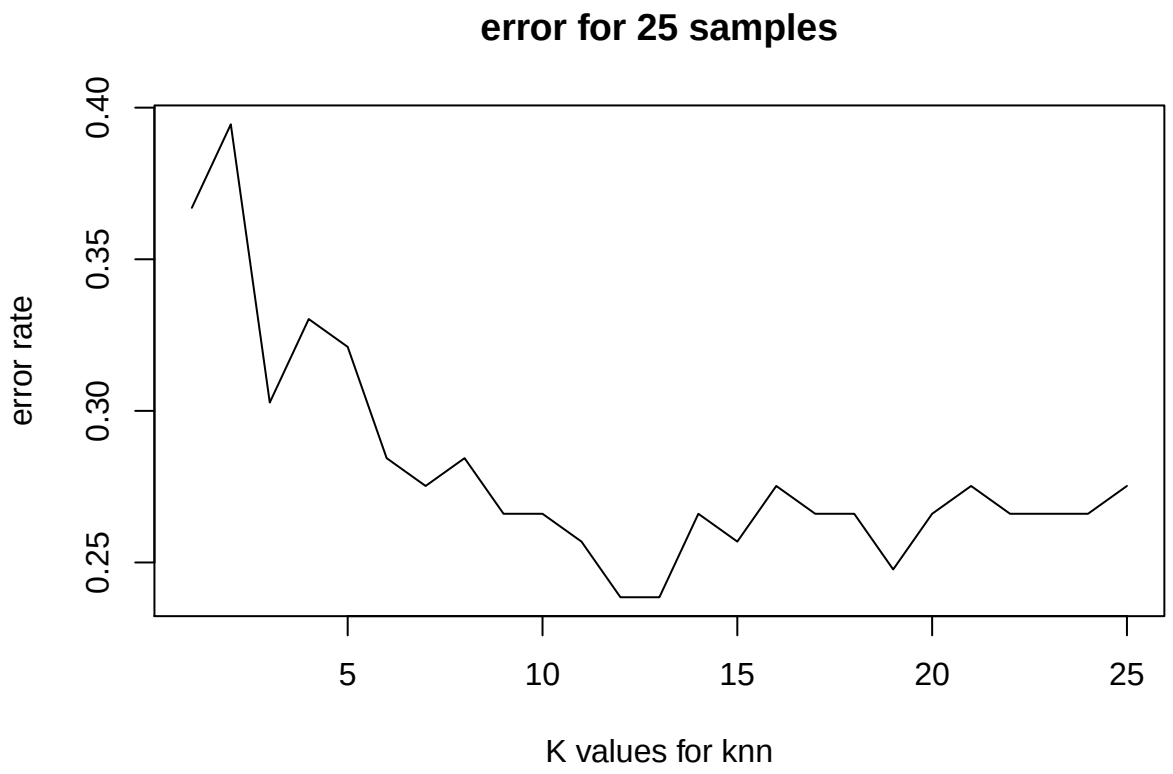
```
## [1] "error = 0.275229357798165"
## [1] "For k =  8"
## [1] "Accuracy = 0.715596330275229"
## [1] "error = 0.284403669724771"
## [1] "For k =  9"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  10"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  11"
## [1] "Accuracy = 0.743119266055046"
## [1] "error = 0.256880733944954"
## [1] "For k =  12"
## [1] "Accuracy = 0.761467889908257"
## [1] "error = 0.238532110091743"
## [1] "For k =  13"
## [1] "Accuracy = 0.761467889908257"
## [1] "error = 0.238532110091743"
## [1] "For k =  14"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  15"
## [1] "Accuracy = 0.743119266055046"
## [1] "error = 0.256880733944954"
## [1] "For k =  16"
## [1] "Accuracy = 0.724770642201835"
## [1] "error = 0.275229357798165"
## [1] "For k =  17"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  18"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  19"
## [1] "Accuracy = 0.752293577981651"
## [1] "error = 0.247706422018349"
## [1] "For k =  20"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  21"
## [1] "Accuracy = 0.724770642201835"
## [1] "error = 0.275229357798165"
## [1] "For k =  22"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  23"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  24"
## [1] "Accuracy = 0.73394495412844"
## [1] "error = 0.26605504587156"
## [1] "For k =  25"
## [1] "Accuracy = 0.724770642201835"
```

```
## [1] "error = 0.275229357798165"
```

```
plot(1:25,accuracies,type="l",ylab=" Testing accuracy ",xlab = "K values for knn",main ="accuracy for 25
```




```
plot(1:25,errors,type="l",ylab=" error rate ",xlab = "K values for knn",main = "error for 25 samples")
```


error for 25 samples
error rate
0.25
0.30
0.35
0.40
5
10
15
20
25
K values for knn